Remarks

The specification and drawings are amended to correct errors of a typographical or editorial nature. Claim 1 is amended to provide proper antecedent basis for a recitation in the claims. No new matter is introduced by any of the amendments, and entry thereof is requested.

Claims 1 - 16 are in the application, of which claims 9 - 14 have been withdrawn as being directed to a nonelected invention. Accordingly, claims 1 - 8, 15 and 16 are now under consideration. Reconsideration of the application, as amended, is requested.

Applicants' invention is directed to a multipackage module having stacked first and second ("upper" and "lower") packages, each package including a die and a substrate, in which the upper package is inverted, wherein z-interconnection between the stacked packages is by wire bonds, and in which the inverted package is a bump chip carrier package.

The points raised in the Office action will now be addressed, beginning with the objections to the drawings.

Drawings Objections

The drawings were objected to on various grounds.

Applicant thanks the Examiner for giving attention to the specification and drawings, and for pointing out errors in reference numeration.

The Examiner objected to the drawings as failing to comply with 37 CFR 1.84(p)(5), asserting that the drawings "do not include the following reference character(s) mentioned in the description: 832." This objection should be withdrawn, in view of the fact that "wire bonds **832**" are indicated in FIG. **8D** of the application as filed, to which the pertinent description refers (paragraph [00178]).

Also, the Examiner objected to the drawings because, the Examiner asserts, "they include the following reference character(s) not mentioned in the description: 11, 43, 47, 142, 50, 52, 313, 305, 306, 86, 90, and 92." The specification is amended herein as appropriate, to correct errors of a typographical or editorial nature, although it is noted that certain of the listed reference characters were, in fact, appropriately mentioned in the specification as filed. No new matter is introduced by any of the amendments herein. A detailed accounting follows:

Amendments to the Drawings

The attached sheets of drawings include changes to FIGs. 6B, 7A, 7B, 7C and 8B. Sheet 5 / 20, which includes FIGs. 6A and 6B, replaces original sheet 5 / 20 including FIGs. 6A and 6B; sheet 6 / 20, which includes FIGs. 7A and 7B, replaces original sheet 6 / 20, including FIGs. 7A and 7B; sheet 7 / 20, which includes FIG. 7C, replaces original sheet 7 / 20, including FIG. 7C; sheet 8 / 20, which includes FIGs. 8A, 8B and 8C, replaces original sheet 8 / 20, which includes FIGs. 8A, 8B and 8C. In FIG. 6B previously omitted reference numerals **406** and **407** (2 instances) are added. In FIG. 7A, 7B and 7C, the lead line running from reference numeral **315** is repositioned. In FIG. 8B reference numerals **304**, **305** (2 instances) and **306** (two instances) replace erroneous instances of reference numerals **354**, **355** and **356**, respectively.

Attachment: Replacement sheets 5 / 20, 6 / 20, 7 / 20, 8 / 20
Annotated sheet[s] showing changes

Reference numeral **11**: the specification is amended herein by insertion of -- **11** -- following "BGA" in paragraph [0018], and this objection can be withdrawn.

Reference numeral **43**: "adhesive **43**" appears in paragraph [0026] of the application as filed (page 6, line26), and the objection as to this reference numeral should be withdrawn.

Reference numeral **47**: the specification is amended herein by insertion of -- **47** -- following "encapsulated" in paragraph [0025], and this objection can be withdrawn.

Reference numeral **142**: "vias **142**" appears in paragraph [0026] of the application as filed (page 6, line 18), and the objection as to this reference numeral should be withdrawn.

Reference numeral **50**: "there is shown ... generally at **50** an embodiment of amulti-package module" appears in paragraph [0097] of the application as filed (page 19, lines 20 - 21), and "MPM **50**" appears for example in paragraph [00113] of the application as filed (page 24, line 25), and the objection as to this reference numeral should be withdrawn.

Reference numeral **52**: "MPM **52**" appears in paragraph [00113] of the application as filed (page 19, line 25), and the objection as to this reference numeral should be withdrawn.

Reference numeral **313**: "underfill **313**" appears in paragraph [00136] of the application as filed (page 31, line 32), and the objection as to this reference numeral should be withdrawn.

Reference numerals **305** and **306**: the specification is amended herein to replace "**355**" with -- **305** -- and to replace "**356**" with -- **306** --; and also to replace "**354**" with -- **304** -- (paragraph [00165]) to make the text consistent with the reference numeration of FIG. **8C** and to avoid use of any reference numeral to identify more than one feature. It is noted that metal layer **355** is sandwiched between dielectric layers **354**, **356** in bottom package substrate **342** (*see, e.g.*, paragraph [00157], FIGs. **8A**, **8B**, **8C**). Accordingly, FIG. **8B** is amended herein to make the reference numeration consistent with that of FIG. **8C**, by replacing the instances of reference numerals **354**, **355**, **356** that are directed to the lower planar part and the legs or sidewalls of the heat spreader, and the adhesive by which the heat spreader is affixed to the substrate, with, respectively, numerals **304**, **305**, **306**, and the objections as to **305** and **306** can be withdrawn

Reference numeral **86**: the specification is amended herein to replace "**84**" with -- **86** -- in paragraph [00177], and the objection as to this reference numeral can be withdrawn.

Reference numerals **90** and **92**: the specification is amended herein by insertion of -- **90**, **92** -- following "embodiments of the invention" in paragraph [00180], and the objections as to **90** and **92** can be withdrawn.

Also, the Examiner objected to the drawings because, the Examiner pointed out, "Fig. 6B has 3 leader lines without references numerals at the end." FIG. 6B is amended herein by insertion of reference numeral **406**, and **407** (2 instances), to be consistent with the description and with the reference numeration of FIG. 6A.

The following typographical or editorial errors relating to the drawings are additionally made herein: In FIGs. 7A, 7B and 7C, the lead line from reference numeral **315** is moved, to indicate the "solder mask", see paragraph [00140]. It is noted that reference numeral **313** indicates the underfill, see paragraph [00136].

In view of the foregoing, it is believed that the objections to the drawings should be withdrawn.

Rejections under 35 U.S.C. § 103(a)

Claims 1 - 8, 15 and 16 were rejected under 35 U.S.C. § 103(a) for obviousness over Lee KR 2001068614 ("Lee") in view of Wu *et al.* U.S. 6,590,281 ("Wu") and Emoto U.S. 6,593,648 ("Emoto"). Applicants disagree with the Examiner's reading of Lee and of Wu, and these rejections are traversed for at least the reasons following.

As to claims 1, 15 and 16, the Examiner asserts that:

> Lee discloses stacked upper and lower packages 20, 30, wherein each package including a die 21, 31 attached to a substrate 22, 33a (i.e. leads). The second package is inverted, wherein the upper and lower substrates 22, 33a are interconnect by wire bonding 40 (see English and Figure).

Lee

The second package (20) in Lee is not inverted.

Generally, according to Applicants' invention the second package is said to be "inverted" because it has the die attach side of the substrate facing toward the first package. That is, where for reference purposes the first package is identified as a "lower" package, and the second package is identified as an "upper" package, the upper package is inverted according to the invention so that the surface of its substrate to which its die is attached is oriented downward. This meaning of "inverted" is shown at many places throughout the drawings and the specification, for example, paragraphs [0040], [0048]; and particularly, where the second ("top") package is an inverted bump chip carrier ("BCC") package, *see, e.g.*, paragraphs [00189] - [00193] and FIGs. 10A, 10B. The die attach side of the leadframe 22 of package 20 in Lee faces away from the first package, that is, the surface of the leadframe 22 to which the die 21 is attached is oriented downward. Accordingly, Lee does not teach or suggest an inverted second package, as in Applicants' claimed invention.

The Examiner acknowledges that Lee "fails to disclose a package comprising a bump ship carrier package," but asserts that:

> Wu discloses a package comprising a bump chip carrier 20 (i.e. carrier that has solder bumps attached to the surface).

Wu

Wu does not disclose a BCC package.

A bump chip carrier is not "a carrier that has solder bumps attached to the surface". Applicants' specification describes the BCC, particularly, for example, at paragraphs [00186], [00187]. A conventional BCC has a "built-up" lead structure formed by serial deposition or plating of patterned thin metal layers on a surface of a sacrificial blank. The blank is later stripped away, following die attach, wire bonding or other interconnect, and molding. The term "bump chip carrier" refers to the convex bumps on the exterior of the BCC package, formed in the built-up metal layers during the deposition of plating process, and which provide a standoff for direct interconnection of the BCC carrier package to an underlying printed circuit, for example. According to the invention, no standoff is required and the "bumps" can be very low (substantially flat), because the upper BCC package is inverted and z-interconnect is made by way of wire bonds connecting sites on the exposed upper surface of the BCC package lead structure and interconnect sites o the lower package substrate (*see*, *e.g.*, Applicants' paragraph [00189]).

Wu describes leadframe packages. In these packages, the leadframe is formed by forming die pad and leads by etching and/or punching a metal sheet (copper or copper alloy). Wu shows (for example in Fig. 4) a chip 25 having a plurality of metallic solder bumps 26 on its active surface 25, by which the chip 25 is electrically connected to the leads 22 of the leadframe 20 (*see*, Wu, Col. 3, lines 43 - 47). The solder bumps provide for first level interconnect of the chip with the leads, and these have nothing to do with the word "bump" in the expression "bump chip carrier" package.

Accordingly, no combination of Lee and Wu makes Applicants' invention as claimed, and the rejections of claims 1, 15 and 16 for obviousness should be withdrawn. Applicants disagree with certain of the Examiner's assertions with reference to the dependent claims; these are not addressed here, inasmuch as claims 2 - 8 depend directly or indirectly from claim 1 and, accordingly, the rejections as to these claims should be withdrawn for the reasons stated above.

Claim 1 is amended to replace to instances of "second" with -- upper --, as antecedent basis is not present earlier in the claim for a recitation of a second package. As Applicants' specification makes clear, the relative terms "upper" and "lower" refer to first and second stacked packages without regard for any particular orientation of the module.

In view of the foregoing, all the claims now in the application are believed to be in condition for allowance, and action to that effect is respectfully requested

This Response is being filed within the first month following the three months' shortened statutory period set by the Examiner for response to the Office action and, accordingly, it is accompanied by a Petition for one month's extension of time and a fee or fee authorization therefor. In the event the Examiner may determine that a further extension of time and/or additional fee[s] may be required in connection with the filing of this paper, petition is hereby made therefor, and the Commissioner is authorized to charge any additional fee (or to credit any overpayment) to Deposit Account No. 50-0869 (CPAC 1029-8).

If the Examiner determines that a conference would facilitate prosecution of this application, the Examiner is invited to telephone Applicants' representative, undersigned, at the telephone number set out below.

Respectfully submitted,

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BK:pfh

Appendix

Replacement sheet[s]

Annotated sheet[s] showing changes

OIPE
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PATENT & TRADEMARK OFFICE
JC11

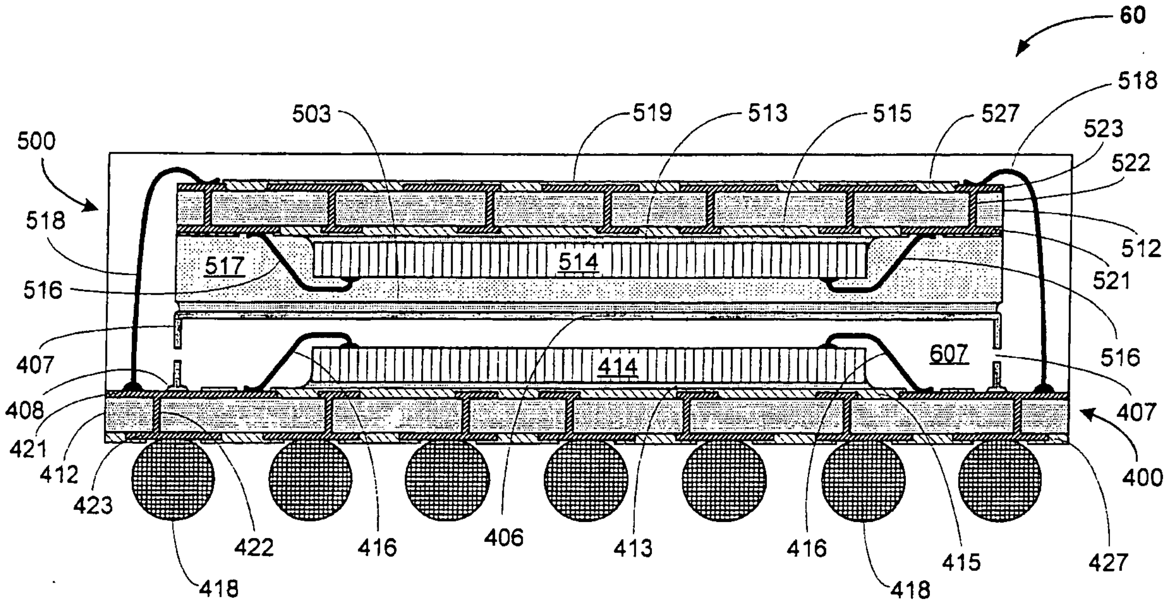

Fig. 6A

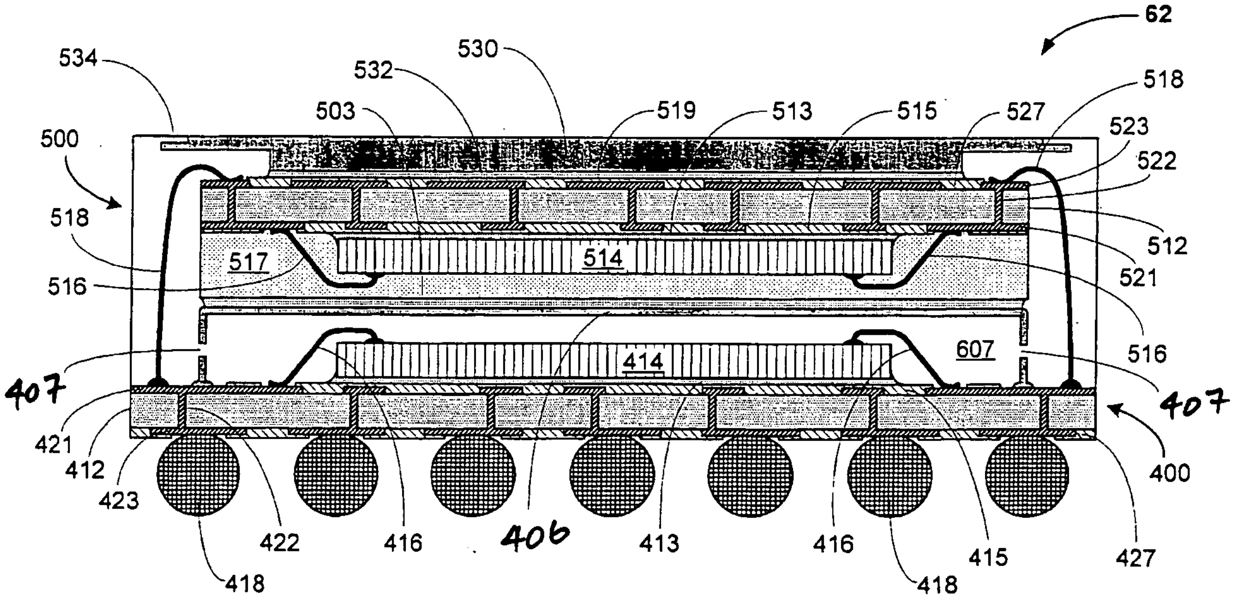

Fig. 6B

Annotated Sheet Showing Changes

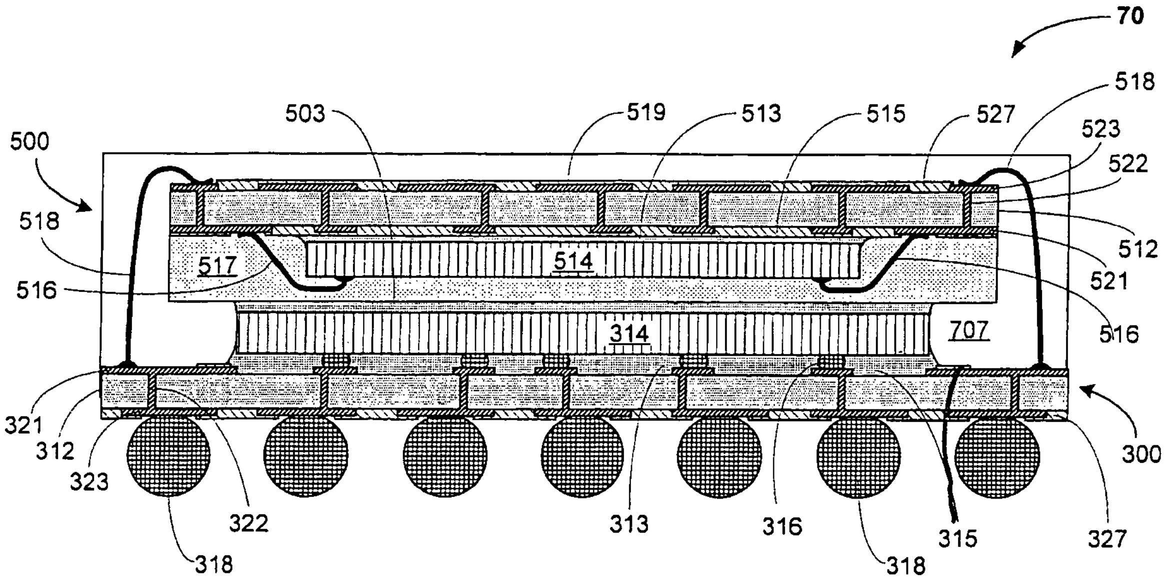

Fig. 7A

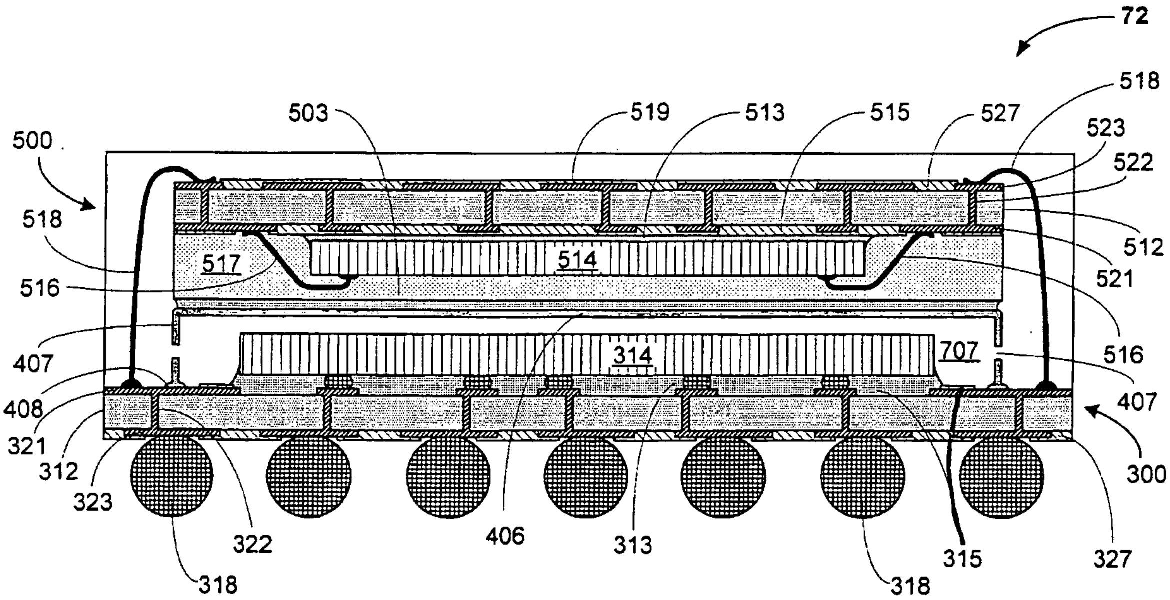

Fig. 7B

Annotated Sheet Showing Changes

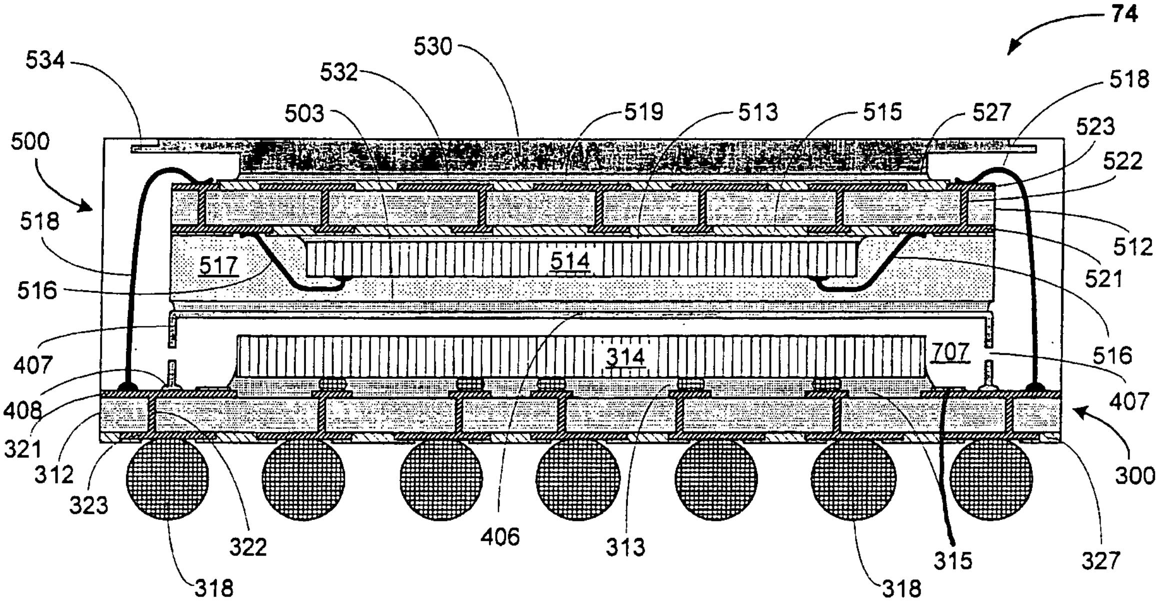

Fig. 7C

Annotated Sheet Showing Changes

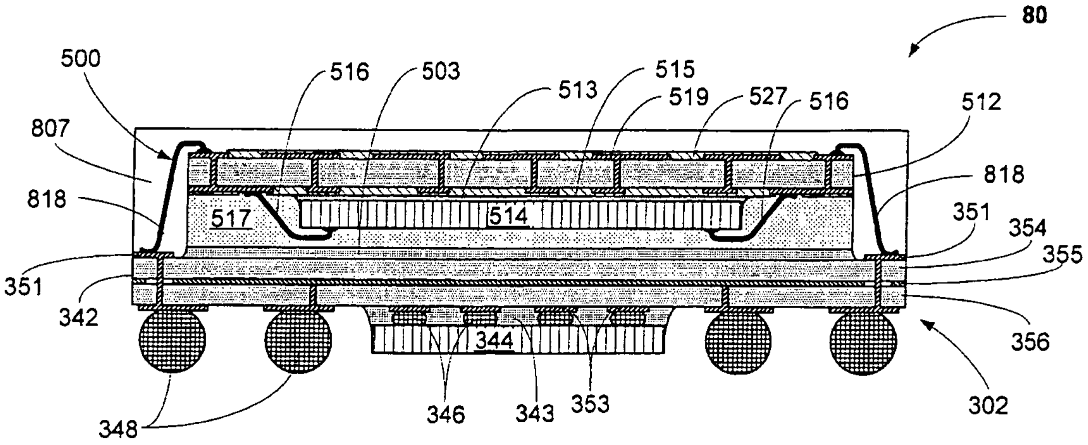

Fig. 8A

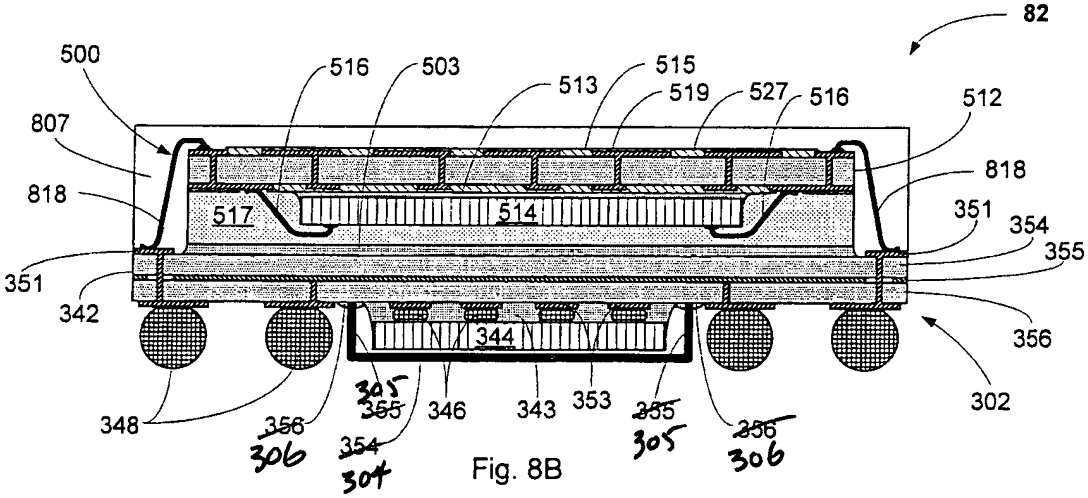

Fig. 8B

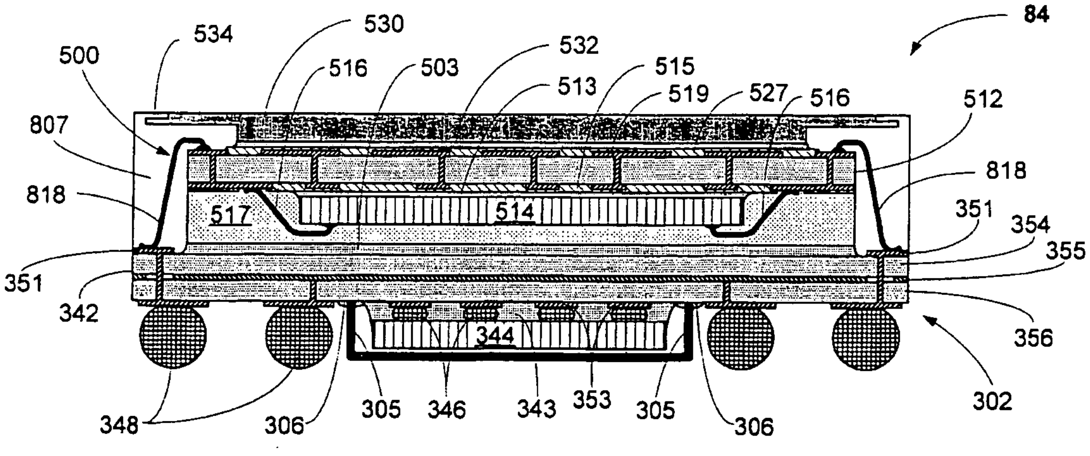

Fig. 8C